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GEOLOGY.—*A spiral graph of geologic time.*[1] David White, U. S. Geological Survey.

While the astronomer teaches the immensity of space, it falls to the geologist to cultivate the conception of geologic time. It is a task he owes to society, for some understanding of geologic time as well as of cosmic distance is an essential part of the background of any well-balanced philosophy of life. In conveying the idea of geologic time mere figures too often lose value with the student as well as the layman. Greater success is reached when the mental image envisages a picture in which numbers are coördinated with some graphic scale. Block diagrams may reflect contrasts in magnitude, but they fail in the attempt to represent geologic length of time. Straight-line horizontal diagrams in normal orientation and clock dial graphs, while passably effective, plunge the layman into the long dark pre-Cambrian, shrouded in greatest ignorance and uncertainty, with the probable result that his first impression of geologic knowledge, as well as time, is unfavorable. Only as the end of the line or the later hours of the dial are approached, the differentiative information becomes more and more exact as well as more complete. The dial has its good psychological points, but the eye travels along the endless circle to pass from the Recent again into the misty Azoic. The trouble with the geologic time graph lies mainly in its beginning and in the pre-Cambrian epochs.

The object of this note is to present an appropriate, stimulating, and more adequate form of graph for use in developing the mental picture of the lapse of geologic time and superposed geologic history. It is offered to illustrate a method, rather than definite conclusions.

[1] Received February 16, 1928.

Borrowing the idea from some recent photographs of spiral nebulae—the mothers of multiple solar systems—I have partly unwound a closely coiled spiral to form the basis of the picture. Vision of the origin and earliest history of the earth is hidden in obscure and uncertain remoteness. The spiral is so complexly intricate that not even the number of turns, and, so, the length of the time line can be discerned. Gradually the line becomes clearer, and presently one meets more or less definitely known, though perhaps distantly isolated and unrelated facts. As the coils roll wider out into clearer view the information increases in amount and diversity, and the historical record unfolds in ever growing distinctness, detail and definiteness of relations. Finally, the mind runs into the impressive facts that Recent time is incredibly brief and that the drama of the evolution of earth and life is still going on.

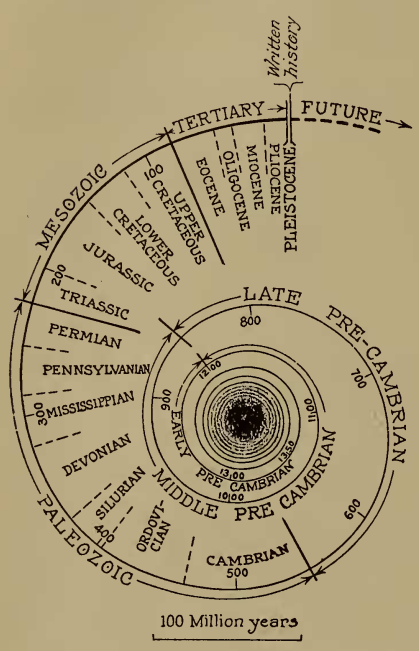

Fig. 1.—Graph illustrating geologic time and the evolution of earth's history.

In Figure 1 the numbers in hundreds (of millions of years) on the spiral accord approximately with and are adjusted to the results reached by Arthur Holmes and A. C. Lawson (Am. Journ. Sci., April, 1927), through (1) the recalculation of the formula for determining the ages of the uranium-bearing rocks by means of viewing the proportions of uranium and uranium lead with reference to the rate of decomposition of the radioactive minerals, and (2) the revisory computation of the ages of a considerable number of uraniferous rocks. In some of these calculations attention was given to thorium lead as well as radium lead. Not all the Holmes-Lawson determinations, most of which relate to Paleozoic and pre-Cambrian rocks, in many cases very indefinitely correlated, were used. The others, and still others to come, may be intercalated by the geologist who may be interested in the measurement of geologic time. The pre-Cambrian time classification is that given by the cited authors. This is the skeleton of the graph.

In laying off the accepted divisions of geologic time one million years was adopted for the Pleistocene, 60 millions for the Tertiary, and so on, in more or less agreement with the calculations by Barrell, Schuchert, and others as to relative length. The demarcation of the periods and epochs is subject to revision to suit the user's convictions.

This geologic time graph lends itself to the uses of geologists whether the object be to show the sequence and duration of the time divisions, the sequence of life, the glacial epochs, the periods of volcanism or diastrophism, or other features or time relations in earth's history.

The curve should be redrawn in better balance proportions.

BOTANY.—*The grass genus* Schizachne.[1] JASON R. SWALLEN, Bureau of Plant Industry. (Communicated by A. S. HITCHCOCK.)

The generic position of one of our native grasses, at present known as *Melica purpurascens*, has been somewhat uncertain. It was first described from North American by Michaux as *Avena striata* and later by Torrey as *Trisetum purpurascens*. From Siberia it was described by Ledebour as *Avena callosa* and from Sachalin Island by Hackel as the type of a new genus, *Schizachne*, which he compared with *Festuca* and *Bromus*. Hitchcock transferred it to *Melica* and Farwell to his new genus *Bromelica*.

An examination of *Melica purpurascens* leads to the conclusion that the species is generically distinct. The texture of the glumes suggests *Melica* but the bearded callus, the strongly nerved lemma, bifid at the apex, the divergent awn, and the brown smooth shining caryopsis are characters not possessed by any species of *Melica* of the section *Bromelica* to which the species is more closely allied than to *Festuca* or *Bromus*. Furthermore the innovations are extravaginal, while those of the section *Bromelica* are intravaginal and the culms are often bulbous at the base.

The species under consideration shows affinities with *Bromus* but the styles are exactly terminal and the caryopsis is entirely free from the palea while in *Bromus* the styles arise below the apex and the caryopsis is adherent to the palea. It also resembles species of *Festuca* but its bifid lemma and bearded callus exclude it from that genus. It differs from *Melica smithii* (Porter) Vasey, which has been grouped with it, in the bearded callus, the more deeply bifid lemma and the smooth caryopsis.

[1] Received February 4, 1928.

In view of these differences it seems best to segregate the species as the type of a distinct genus, taking up the name *Schizachne* Hack.

The geographic distribution of *Schizachne*, which is monotypic, is similar to that of a number of species mentioned by Asa Gray,[2] being found in northern North American and eastern Asia. This distribution was recognized as early as 1842 by Turczaninow[3] who referred his collections, later described as *Avena callosa*, to *Avena striata* Michx. Hultén,[4] in his Flora of Kamtchatka, also states that Asiatic specimens agree completely with the American ones.

Schizachne Hack.

Spikelets several-flowered, articulate above the glumes and between the florets, the rachilla glabrous; glumes unequal, 3 and 5-nerved respectively; lemma lanceolate, strongly 7-nerved, long-pilose on the callus, awned from just below the teeth of the prominently bifid apex; palea with softly pubescent, thickened submarginal keels, the hairs longer toward the summit; ovary glabrous, the styles exactly terminal; caryopsis dark reddish brown, very smooth and shining. Type species, *S. purpurascens*.

Schizachne purpurascens (Torr.)

Avena striata Michx. Fl. Bor. Amer. **1:** 73. 1803. Not *Avena striata* Lam. Collected by Michaux "a sinu Hudsonis ad Lacus Mistassins." Type in Muséum d'Histoire Naturelle at Paris. A fragment in the U. S. National Herbarium has been examined.

Trisetum purpurascens Torr. Fl. North. & Mid. U. S. **1:** 127. 1823. A cited specimen in the Torrey Herbarium, at the New York Botanical Garden, has been examined. It is labeled in Torrey's handwriting, "Trisetum purpurascens Tor. fl. near Montreal."

Avena callosa Turcz. in Ledeb. Fl. Ross. **4:** 416. 1853. "Catal. Baic. nr. 1295" is cited. Judging from the description and a specimen from "Vallis U-scha-gon, Siberia," *Kamerov* 163, there is no doubt that this is identical with *Schizachne purpurascens*.

Avena striata forma *albicans* Fernald, Rhodora **7:** 244. 1905. "Quebec, abundant on mossy tableland, altitude 900–1500 meters, Mt. Albert, Aug. 9, 1905." [*Collins & Fernald* 26] The characters are not sufficient to distinguish it from the species.

Melica striata (Michx.) Hitchc. Rhodora **8:** 211. 1906. Based on *Avena striata* Michx.

Melica purpurascens (Torr.) Hitchc. Contr. U. S. Nat. Herb. **12:** 156. 1908. Based on *Trisetum purpurascens* Torr.

Schizachne fauriei Hack. Repert. Sp. Nov. Fedde **7:** 323. 1909. "Insula Sachalin, in silvis prope Korsakof, Faurie 803." A portion of the type from the Hackel Herbarium has been examined.

[2] Proc. Amer. Assoc. **21:** 1–31. 1872.

[3] Bull. Soc. Nat. Moscou **15:** 16. 1842.

[4] *Flora of Kamtchatka and the Adjacent Islands* **1:** 118. 1927.